

Prof. Huxley first correctly determined the homologies of the enamel-organ and the dentine-papilla, referring the first to the epithelium, the latter to the derm ; the follicle, however, where it exists at all, I regard as mainly a secondary development from that region of the derm which formed the base of the dentine-germ.

Observations upon many mammals, reptiles, and fishes lead me to the following general conclusions as to the development of teeth :—

(i.) All tooth-germs whatever consist, in the first instance, of two parts, and two alone—the dentine-papilla and the enamel-organ.

(ii.) The existence of an enamel-organ is wholly independent of the presence or absence of enamel upon the teeth ; examples of this have been recorded by Professor Turner and by myself among mammalia, and by myself among reptiles and fishes.

(iii.) Nothing justifies the arbitrary division into “ papillary,” “ follicular,” and “ eruptive” stages ; nor does any open primitive dental groove, or fissure, exist in any animal examined.

(iv.) In all cases, an active ingrowth of a process of the oral epithelium, dipping inwards into solid tissue, is the first thing distinguishable ; although the formation of a dentine-papilla, opposite to its deepest extremity, goes on *pari passu* with the development of its caecal end into an enamel-organ.

(v.) A special capsule, or follicle, to the tooth-germ may or may not be present ; when present, it is, in part, a secondary development from the base of the dentine-papilla, in part, a mere condensation of surrounding tissue.

II. “Researches upon the Specific Volumes of Liquids.” By T. E. THORPE. Communicated by Prof. WILLIAMSON, For. Sec. R.S. Received March 2, 1875.

(Abstract.)

I. *On the Atomic Value of Phosphorus.*

Hermann Kopp has shown that, as a rule, the specific volume of an element is invariable when in combination. Exceptions to the law occur, however, in the cases of oxygen and sulphur, each of which bodies has two specific volumes dependent upon the manner in which they are held in union. When contained “within the radicle,” as in acetyl,  $C_2H_5O$ , oxygen has the value 12.2, but when existing “without the radicle,” as in alcohol, it has the smaller value, 7.8. Sulphur, when “within the radicle,” has the specific volume 28.6 ; when “without the radicle,” it has the specific volume 22.6.

The cause of these variations may be thus stated in the language of modern theory :—When dyad sulphur and oxygen are united to an element by both their affinities, their specific volumes become respectively

28.6 and 12.2 ; when they are attached by only one combining unit, their specific volumes are 22.6 and 7.8.

Phosphorus is regarded by certain chemists as invariably a triad ; others maintain that it is sometimes a triad, at other times a pentad. In the trichloride it is a triad, in the oxychloride and thiochloride it is a pentad. According to this view, the two latter compounds possess the following constitution :—



If, however, phosphorus is invariably trivalent, the oxychloride and thiochloride must possess the formulæ



It is possible to decide between the two modes of representing the constitution of these compounds, if it be granted that the variation in the specific volume of oxygen and sulphur is due to the manner in which these elements are held in union. For, if the phosphorus in the oxychloride and thiochloride be quinquevalent, the oxygen and sulphur must possess the greater of the two values, since both their combining units are united to the phosphorus ; if, on the other hand, phosphorus be trivalent, the oxygen and sulphur must possess the smaller of the two values.

The author has determined the specific gravity, boiling-point, and rate of expansion of  $\text{PCl}_3$ ,  $\text{POCl}_3$ , and  $\text{PSCl}_3$ , in order to ascertain the specific volume of the oxygen and sulphur in the two latter compounds, and consequently the chemical value of the phosphorus ; and he finds that the specific volumes of the oxygen and sulphur are almost identical with the values given by Kopp for these elements when "without the radicle." It would therefore appear that the oxychloride and thiochloride must possess the constitution



and that the phosphorus in these bodies is to be regarded as a triad.

The author concludes by discussing Buff's hypothesis, that the specific volume of an element varies with its chemical value ; and he shows that, in the case of phosphorus, there are no reasons for the belief that this element has a variable specific volume.